

Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

MEMORANDUM

To: EPA
From: LDWG
Subject: NOAA juvenile chinook salmon tissue data
Date: February 15, 2004

In response to a request from EPA, this memorandum describes the potential risk implications of including juvenile chinook salmon tissue data collected by the National Oceanic and Atmospheric Administration (NOAA) in the Lower Duwamish Waterway (LDW) Phase 2 Ecological Risk Assessment (ERA) and Remedial Investigation (RI). In question are datasets reported by NMFS (2002) and Varanasi et al. (1993), in which whole body concentrations of chemicals were analyzed in the tissue of field-collected juvenile chinook salmon collected from the LDW. These tissue data were the only juvenile chinook salmon data available for use in the Phase 1 ERA. EPA recommended that if these datasets are to be used for the Phase 2 ERA, the Lower Duwamish Waterway Group (LDWG) should obtain and review the quality control (QC) summary reports and analytical data for all QC analyses associated with these data and verify the validation reports. However, as EPA has found in reviewing other data sets from NOAA, the necessary QC information is available but not in the form of standard Contract Laboratory Program-type deliverables. This situation requires additional time on the part of EPA and NOAA chemists to obtain and review the necessary information.

Two additional juvenile chinook salmon whole body tissue concentration datasets beyond those used in the Phase 1 ERA have been collected from the LDW: juvenile chinook salmon collected for the East Waterway Operable Unit, Harbor Island Superfund site evaluation (Windward 2002) and juvenile chinook salmon collected for the LDW Phase 2 Remedial Investigation (RI) (Windward 2004a). These data sets are supported by complete and well-documented quality assurance and quality control (QA/QC) review. A summary of all available LDW juvenile chinook salmon whole body tissue concentration data is presented in Table 1.

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Table 1. Summary of available LDW whole body^a juvenile chinook salmon tissue data

TITLE	YEAR	N ^b	NUMBER OF FISH PER COMPOSITE SAMPLE	CHEMICALS ANALYZED	GC
NMFS Duwamish Injury assessment project (NMFS 2002)	2000	28 ^c	1-10	PCBs, organo-chlorine pesticides	Not available
Contaminant exposure and associated biochemical effects in outmigrant juvenile chinook salmon from urban and non-urban estuaries of Puget Sound (Varanasi et al. 1993)	1989-1990	14	2-10	PCBs, organo-chlorine pesticides, PAHs	Not available
EW-salmon (Windward 2002)	2002	6	6-7	PCBs, mercury	Windward 2002
Phase 2 LDW RI-salmon (Windward 2004a)	2003	18	8-10	PCBs, organo-chlorine pesticides, TBT	Windward 2004b

^a The suitability of the NOAA stomach contents PAH concentration data (Varanasi et al. 1993) for inclusion in the Phase 2 ERA is not addressed in this memo and will be addressed separately

^b Number of composite samples

^c Twenty of 29 samples were individual fish, not composite samples

Tables 2 and 3 present summary statistics for total PCBs and total DDTs calculated from the LDW juvenile chinook salmon data with and without the two NOAA datasets.

These statistics show that for both total PCBs and total DDTs, the 95% UCL on the mean is similar with or without inclusion of the NOAA datasets. For total PCBs, inclusion of the NOAA datasets decreases the 95% UCL on the mean (from 235 to 167 µg/kg ww). Inclusion of the NOAA datasets had little effect on the 95% UCL on the mean for total DDTs (36 µg/kg ww without the NOAA datasets and 31 µg/kg ww with the NOAA datasets).

Table 2. Total PCBs concentration (µg/kg ww) in juvenile chinook salmon

	NOAA COMPOSITE SAMPLES (n=23)	NOAA INDIVIDUAL FISH SAMPLES (n=20)	NOAA COMBINED DATA (n=26 ^a)	PHASE 2 DATA (n=24)	NOAA AND PHASE 2 DATA (n=50)
Minimum	21	14	17	6.9	6.9
Mean	104	101	103	144	123
Maximum	260	750	260	1200	1200
95% UCL on the mean	130	167	160	235	187

^a n = 23 + 3 statistically derived composite samples were formed from the 20 individual fish as follows. Seven individual whole body concentrations were averaged to construct an additional single composite sample for Slip 4. The 13 individual whole body concentrations from Kellogg Island were allocated to two groups (one of size six and one of size seven) to mathematically construct two additional composite samples for Kellogg Island. Hatchery or wild origin of fish was not considered in allocating fish to composite samples because ROCs that consume juvenile chinook salmon would not distinguish between these two types of salmonids in the field. To achieve the most conservative exposure point concentrations, the samples with the highest concentrations were allocated to one composite (of size six), although random assignment produced the same result.

Table 3. Total DDTs concentration (µg/kg ww) in juvenile chinook salmon

	NOAA COMPOSITE SAMPLES (n=23)	NOAA INDIVIDUAL FISH SAMPLES (n=20)	NOAA COMBINED DATA (n=26 ^a)	PHASE 2 DATA (n=18)	NOAA AND PHASE 2 DATA (n=44)
Minimum	12	2.0	3.0	1.4	1.4
Mean	29	11	27	25	28
Maximum	49	21	49	87	87
95% UCL on the mean	34	14	31	36	31

^a n = 23 + 3 statistically derived composite samples were formed from the 20 individual fish, as described above

^b Total DDTs not analyzed in EW-salmon

IMPLICATIONS FOR RISK ESTIMATES

In the Phase 1 ERA, juvenile chinook salmon tissue data were used to calculate risks from total PCBs to juvenile chinook salmon, bald eagles, harbor seals, and river otters. Bald eagles and harbor seals each were assumed to consume 33% of their diet as juvenile chinook salmon, and river otters were assumed to consume 29% of their diet as juvenile chinook salmon. For the comparative analysis of risks from total DDTs in this memorandum, bald eagles, harbor seals, and river otters were assumed to consume 100% juvenile chinook salmon, because in the Phase 1 ERA, bald eagles and harbor seals were evaluated for risks from total DDTs only in the screening analysis where their diet was conservatively estimated to be 100% perch (the fish with the highest total DDT concentration). In the Phase 1 ERA, Total DDTs were not screened for river otters because of lack of effects data. In this memorandum, risk to river otters from DDTs was

analyzed using the Phase 1 harbor seals DDTs TRV used in the screening analysis. Total PCB and total DDT risk estimates using Phase 1 exposure assumptions and toxicity reference values (TRVs) are presented in Table 4 for three scenarios:

- Using only NOAA datasets (i.e., Phase 1 ERA results),
- Using EW and Phase 2 datasets, and
- Using all datasets.

Table 4. Summary of risks calculated using different juvenile chinook salmon datasets

RECEPTOR	COPC	PHASE 1 ERA DATA				NOAA, EW AND PHASE 2 DATA	
		HIGHEST NOEC/LOEC/LQEL HQ	HIGHEST NOEC/LOEC/LQEL HQ	HIGHEST NOEC/LOEC/LQEL HQ	HIGHEST NOEC/LOEC/LQEL HQ	HIGHEST NOEC/LOEC/LQEL HQ	HIGHEST NOEC/LOEC/LQEL HQ
Juvenile chinook salmon	PCBs	0.0023	0.0013	0.0034	0.0020	0.0024	0.0014
	DDTs	0.017	0.010	0.020	0.012	0.017	0.010
Bald eagle	PCBs	0.29	0.13	0.30	0.13	0.29	0.13
	DDTs	0.054	na	0.081	na	0.054	na
Harbor seal	PCBs	0.69	0.069	0.70	0.070	0.69	0.069
	DDTs	0.0018	na	0.0020	na	0.0018	na
River otter	PCBs	8.5	0.85	8.7	0.87	8.5	0.85
	DDTs	0.0078	na	0.0087	na	0.0078	na

HQs greater than 1.0 are noted in bold type

na – not available (no Phase 1 TRV developed)

COPC – chemical of potential concern

NOEC – no observed effect concentration

NOAEL – no observed adverse effect level

LOEC – lowest observed effects concentration

LQEL – lowest observed adverse effects level

HQ – hazard quotient

As shown in Table 4, there are no pronounced changes in the overall risk conclusions among the different scenarios evaluated. The changes observed in HQs are negligible. For example, the total PCB HQ for river otter changes by two tenths, from 8.5 to 8.7. Based on the analysis presented in this memo, exclusion of the NOAA juvenile chinook salmon whole body concentrations datasets¹ from the Phase 2 ERA should not affect the risk estimates for total PCBs or total DDTs. Given this, and that only the Windward (2002; 2004a) datasets are backed by complete QA/QC review and documentation, only

¹ The suitability of the NOAA stomach contents PAH concentration data (Varanasi et al. 1999) for inclusion in the Phase 2 ERA is not addressed in this memo and will be addressed separately

the Windward (2002; 2004a) juvenile chinook salmon whole body concentrations PCBs and DDTs datasets should be used in the Phase 2 ERA.

REFERENCES

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